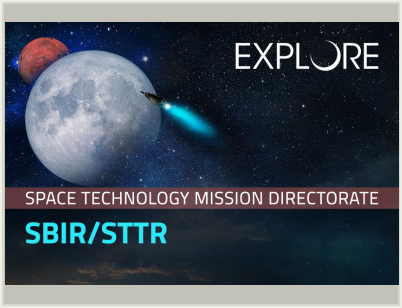
# High-Volume Production of Lightweight, Multi-Junction Solar Cells Using 6-inch GaAs, Phase I

Completed Technology Project (2012 - 2012)

## Project Introduction

Very large solar arrays to power future solar electric propulsion systems will require a new generation of solar cells that are not only high efficiency, but also light weight and significantly lower cost than existing multijunction solar cells based on Ge substrates. The large volume of solar cells required for individual missions (hundreds of kilowatts to megawatts) also presents significant manufacturing challenges. MicroLink Devices' multijunction solar cells based on epitaxial lift off (ELO) provide the unique combination of high efficiency, high specific power, and low cost by enabling reuse of the GaAs substrate after lift off. The use of GaAs substrates leverages a platform well-established by the GaAs IC industry at 6-inch diameter, which is also a significant enabler for cost reduction and volume production. Larger substrates not only reduce epitaxial growth and fabrication costs, but improve wafer utilization when fabricating large-area solar cells. MicroLink Devices' ELO solar cells are also highly flexible, which enables new approaches for panel fabrication and deployment. In this SBIR program we will demonstrate the capability for high-volume epitaxial lift off using 6-inch GaAs material. Our previous development efforts at MicroLink Devices have focused primarily on 4-inch wafers. We will fabricate the first large-area (20 cm2) multijunction ELO solar cells on 6-inch GaAs and compare performance with 4-inch ELO material. To support the fabrication of hundreds of kilowatts of solar cells for very large arrays, it is essential that the ELO substrate removal process is capable of supporting very high volumes of wafers on the scale of hundreds to thousands of wafers per day. We will demonstrate a 6-inch ELO process based on well-established semiconductor industry volume production tool sets and batch processing to achieve high throughput. The impact of using large wafer batches on the ELO process yield and device performance will be quantified.

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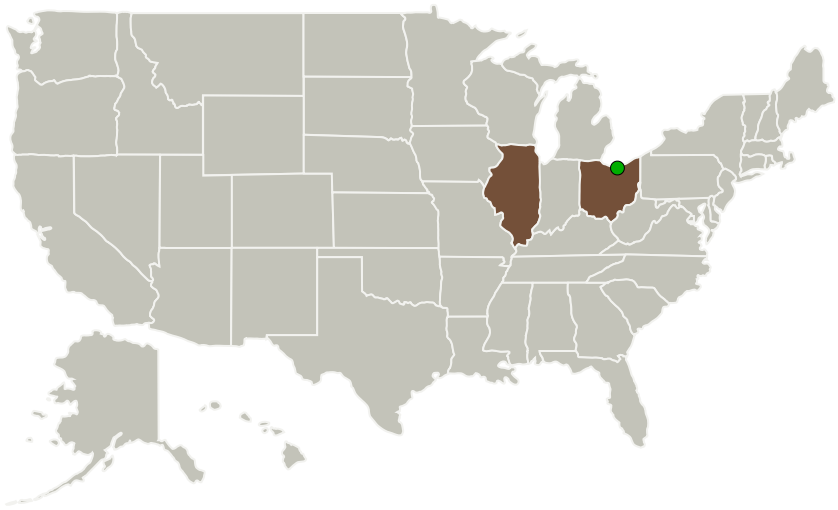
## Primary U.S. Work Locations and Key Partners



| Organizations Performing Work | Role | Type | Location |
|---|---|---|---|
| MicroLink Devices, Inc. | Lead Organization | Industry<br>Minority-Owned Business | Niles, Illinois |
| Glenn Research Center(GRC) | Supporting Organization | NASA Center | Cleveland, Ohio |

| Primary U.S. Work Locations | |
|---|---|
| Illinois | Ohio |

## Project Transitions

**February 2012:** Project Start

**August 2012:** Closed out

**Closeout Documentation:**

- Final Summary Chart*(https://techport.nasa.gov/file/140317)*

## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Organization:**

MicroLink Devices, Inc.

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

**Principal Investigator:**

Christopher Youtsey

**Co-Investigator:**

Christopher Youtsey

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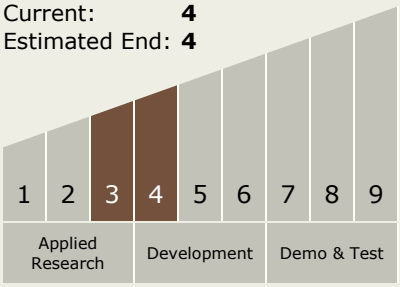
## Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**




## Technology Areas

**Primary:**

- TX03 Aerospace Power and Energy Storage
  - TX03.1 Power Generation and Energy Conversion
    - TX03.1.1 Photovoltaic

## Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System